Image Resolution Enhancement by Discrete and Stationary Wavelet Decomposition using Bicubic Interpolation

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Abstract

Now a day image are contained some blur type structure because of some interpolation technique and the present decomposition technique. To decompose an image there are few techniques available but they are that much enough to increase the resolution of image.

So, to increase the resolution of image this paper proposes a technique that increases the resolution by using interpolation, discrete and stationary wavelet decomposition.

The DWT and SWT is applied on the input image and these techniques are applied to decompose an image into different sub bands out of these sub-bands the high frequency sub bands are interpolated by using the interpolation technique. Then all the high frequency sub bands are combined and to generated a new high resolution image by using inverse DWT (IDWT).

1. Introduction

Resolution is the details of image and it is frequently referred as an important parameter of an image to get a high resolution image, these images are being processed by some techniques.

For the better resolution of image, one of the best techniques is interpolation such as bicubic interpolation the interpolation technique has been used in many image processing application such as super resolution [2-3], multiple description coding [4] and facial reconstruction [5]. There are some other interpolation techniques which are also being used like neighbour interpolation bilinear interpolation.

To increase the resolution of image in a wavelet domain is relatively new research topic. There are some new algorithms introduced in [6-7]. Descript wavelet transform (DWT) [8] is recently used technique which decomposes an image into four different sub bands namely low-low (L.L.), Low-High (L.H.), High-Low (H.L.), High-High (H.H.). Stationary wavelet transform (SWT) is a technique similar to Descript Wavelength Transform (DWT) but does not use down sampling so the output of SWT is double of an input image. SWT decompose image into four sub bands namely low-low (L.L.), Low-High (L.H.), High-Low (H.L.), High-High (H.H.) form the sub bands of DWT and SWT, the high frequency sub bands are interpolated by using bicubic interpolation technique. The bicubic interpolation technique give more approximation pixels value of a decompose image. These values help to increase the resolution of the image.

The interpolated high frequency signals of DWT, SWT and low resolution image with interpolation factor ($\alpha/2$) are combined by using inverse DWT (IDWT) to achieve high resolution image.

2. Propose Image Resolution Enhancement Technique

The main laws of image by using interpolation technique on high frequency component is edges, with is due to smoothing. To increase the resolution of image, reserving the edges are important. In this work DWT and SWT are used to preserve the high frequency component of image i.e. Low-High (L.H.), High-Low (H.L.), High-High (H.H.) frequency component.

In this technique one level DWT is used by using db1 wavelet to decompose an image into different sub bands. Three high frequency sub bands are then interpolated by using bicubic interpolation technique with use of down sampling.

SWT decomposes the image using the same db1 wavelet into four different sub bands. Three high frequency sub bands are then interpolated by using bicubic interpolated technique but not use of down sampling.

These high frequency sub bands of SWT, DWT and interpolated low resolution image with factor ($\alpha/2$) are combined by using inverse DWT to achieve the high resolution image.

Low frequency component are obtained from low pass filter of DWT and SWT. The high frequency components are obtained from high pass filter of DWT and SWT.

The figure 1 shows the block diagram of propose image resolution enhancement technique.

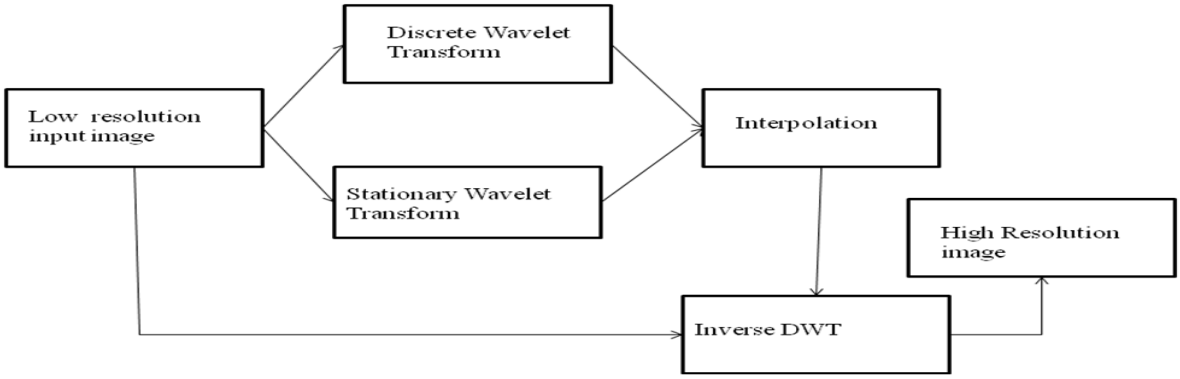

Figure 1 : Block Diagram of proposed System

Figure 2: structure of wavelet decomposition

The decomposition of image after applying one level DWT and SWT are shown in figure 2 Low-Low(L.L) Low-High(L.H.), High-Low(H.L.), High-High(H.H.) frequency component

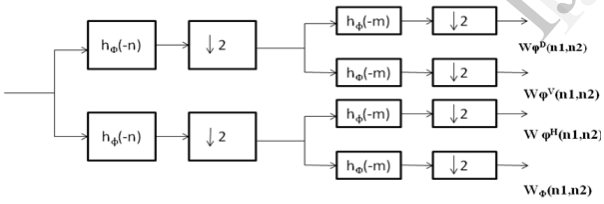

Figure 3: Structure of DWT decomposition

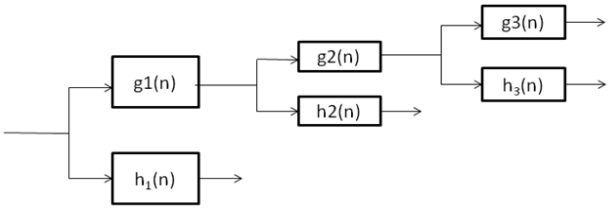

Figure 4 Structure of SWT decomposition

The figure 3 and 4 shows the structure of DWT and SWT details coefficient and approximation coefficient of image Low-Low(L.L) Low-High(L.H.), High-Low(H.L.), High-High(H.H.) frequency component

3. Results and Discussion

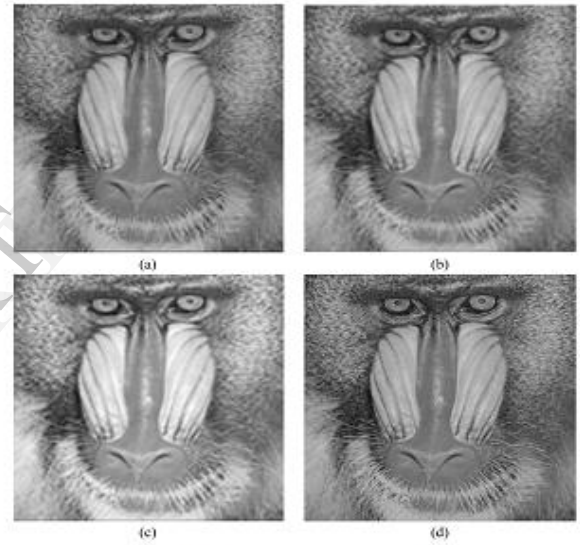

Figure 5: High resolution image of Babbons

Figure 5 shows the high resolution image of Baboon picture using propose technique i.e. bicubic interpolation in (d) are much better than low resolution input image in (a), (b) shows neighbour interpolation technique and (c) shows bilinear interpolation technique.

4. Conclusion

This paper proposes image resolution enhancement technique by DWT and SWT decomposition by using bicubic interpolation. By applying DWT and SWT to image taking the interpolation and simultaneously
interpolated low resolution image are combined by using inverse DWT to achieve the high resolution image.

5. References

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